



# Learjet Flight Test Update

Commercial Supersonic Technology Project  
Advanced Air Vehicles Program

*NASA Glenn Research Center (Acoustic Testing, Weather Measurements, Airworthiness/Flight Ops, Management)*

*NASA Langley Research Center (sUAS Operations, Weather Measurements)*

# Team

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Research: Brenda Henderson (Glenn)  
Lennart Hultgren (Glenn)  
Devin Boyle (Glenn)

Airworthiness/Flight Ops, Project Management: Jeff Polack (Glenn)  
Matt Fakler (Glenn)  
Kurt Blankenship (Glenn)

sUAS Operations and Related Weather Measurements: Mark Motter (Langley)  
Jake Revesz (Langley)  
Jen Fowler (Langley)  
Thomas Jordan (Langley)

LIDAR Weather Measurements: Devin Boyle (Glenn)

# Objectives

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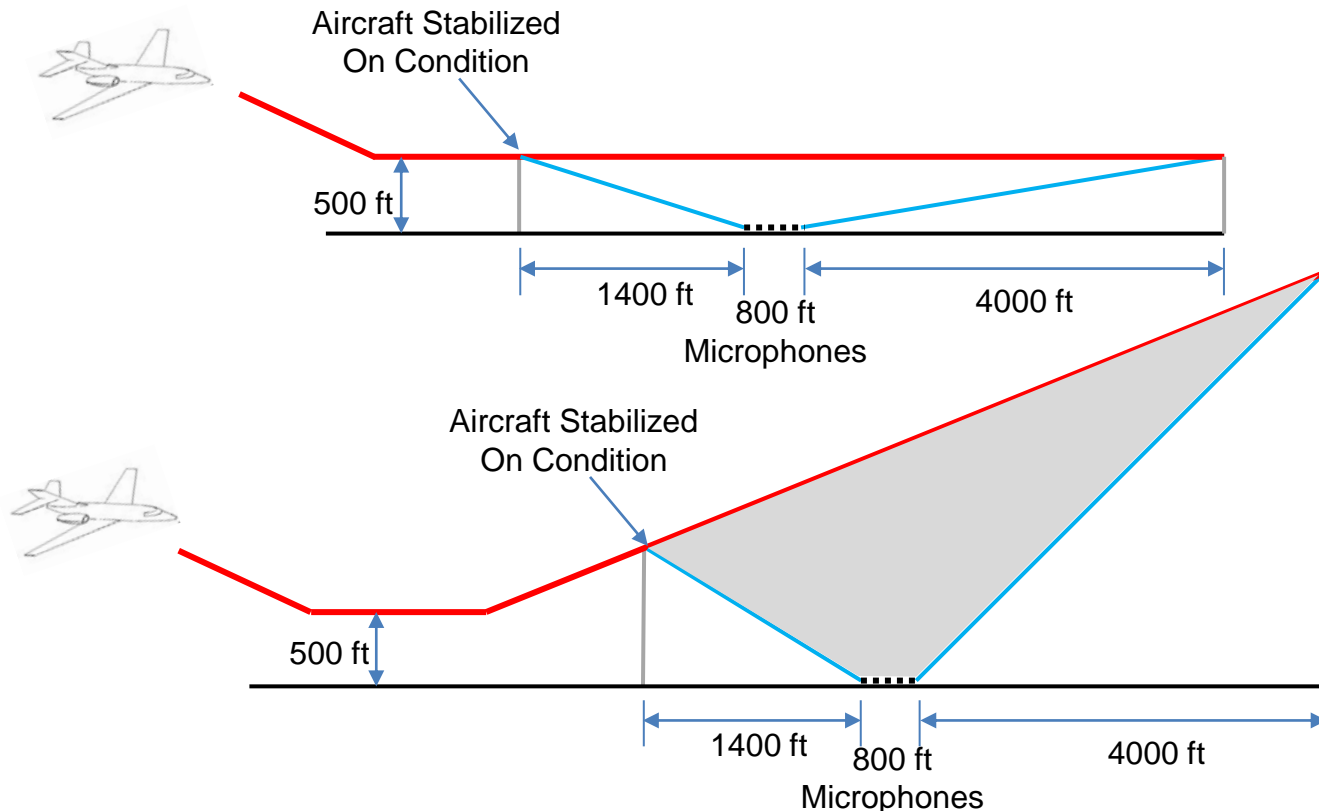
- Acquire jet-noise flight data from a Learjet 25
  - Compare results from AAPL to flight data
  - Develop flight correction model if required
- Learjet 25 selected to ensure a jet-noise dominated source
  - Uses CJ610 engine (derivative of the J85)

Desired outcome is to improve our ability to predict takeoff noise for future supersonic commercial aircraft

# Learjet Flight Test Details

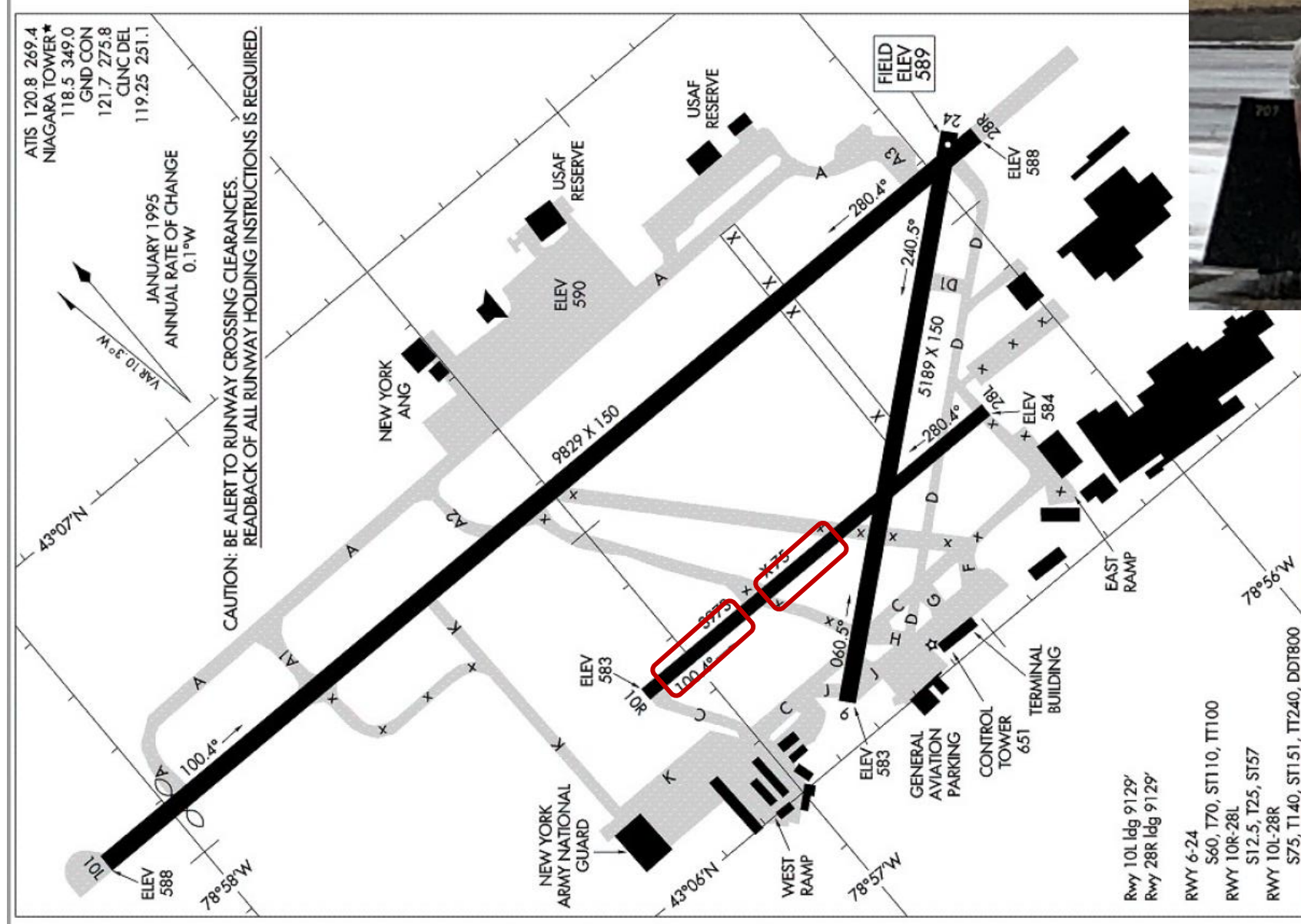


- Aircraft will be operated and instrumented by Calspan Corp.
  - Engine Pressure Ratio (EPR), Exhaust Gas Temperature (EGT), and engine RPM will be recorded
  - L1 and L2 GPS antenna
  - Recorded data will include a GPS timestamp
  - One engine will be at idle
  - Flight trajectories will include level flyover and climb to achieve desired engine conditions and flight speed
  - Flights will occur at Niagara Falls International Airport



- Preflight used to determine achievable engine conditions and flight speeds
  - Flight speeds will remain at or below Mach 0.3
  - Engine exhaust of interest in the mid subsonic and low supersonic regime

# Planned Array Location



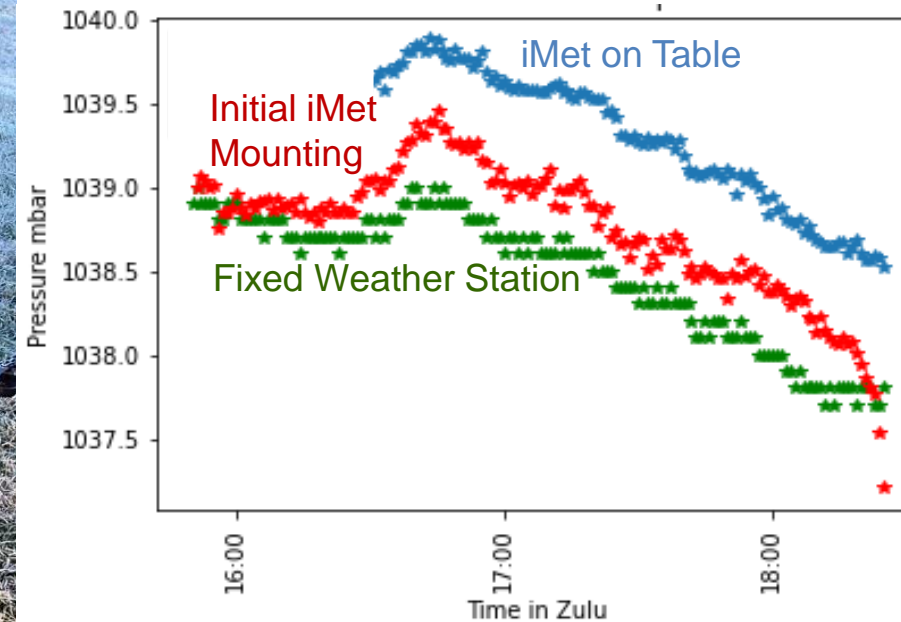
- Aircraft
  - Combined IMU (Inertial Measurement Unit) and GPS unit, and logging computer
  - Receiver is L1 and L2 capable
  - Aircraft location will be determined using post-processed kinematic (PPK) techniques (cm accuracy possible)
  - New York state base station within ~ 30 km (L1 and L2 needed for > 10 km)
- Acoustics
  - 8 Ground plate microphones will be used in the microphone array (the intent of this test is not certification type data)
  - Array will be located directly beneath the flight path
  - Microphone array will be GPS timestamped
- Weather – layered atmospheric conditions recorded up to an altitude of ~600 ft
  - Using an sUAS for temperature, pressure, humidity
  - LIDAR system (on loan from Langley, operated by Glenn) for wind speed



# sUAS Weather Measurements



- sUAS – Freely Alta 8
  - Autopilot used for flights
- Instrumentation
  - Pressure, temperature, humidity
    - iMet-XQ2
      - Built-in data logger
      - Data GPS timestamped
      - Validation against stationary weather station
  - Altitude
    - Second autopilot with RTK system (only used for RTK)
      - Base station included in Langley setup
    - Combination laser altimeter (distance limitation) and barometric pressure
    - Data GPS timestamped
- Data acquired before and after Learjet flights and at intervals in-between (maybe 1/hour)



# LIDAR Measurements



- NGR Systems Inc., Model ZX300
- Used for wind speed
- Unit used by RVLT project for helicopter and UAM/AAM field measurements
- Will be loaned to Glenn and CST project for Learjet test





# T-34 GPS Trial Flights



- Cleveland Area
  - Ensure GPS system is functioning properly
- Niagara Falls International Airport
  - Ensure ability to record necessary satellite and base station data in flight test location



# Schedule



Task	Date
Contract Award	September 2021
Site Visit to Select Test Location	January 2022
Weather Station Drone Flights Initiated	February 2022
All Required Hardware Delivered	February 2022
T-34 Flight Test for GPS Checkout	April - May 2022
Learjet Pre-Flight and Flight Tests	June - July 2022

## Additional Details

- All required and most backup hardware has been delivered

# Questions and Feedback

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